

AERIAL OXIDATION OF TETRAETHYL SILICATE AND EFFECT ON AMMONIA CATALYZED HYDROLYSIS

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Abstract

Colloidal suspensions of SiO_2 ethanol prepared by the ammonia catalyzed hydrolysis of tetraethyl silicate (TEOS) in ethanol (Stober process) have been routinely used for over 10 years to prepare antireflective coatings on the fused silica optical components of high power fusion lasers. Very high purity coatings are required to avoid laser damage and the TEOS is fractionally distilled under nitrogen prior to use.

Recently we have found that the impurities caused by aerial oxidation of distilled TEOS have a significant effect on the particle size of our coating suspensions to the detriment of the optical performance. We require particle size to be in the range 20-30 nm to avoid light loss due to scatter in the coatings and contaminated TEOS has given suspensions with particle sized much higher. Oxidation products include acetaldehyde and acetic acid and these are readily formed in nominally pure TEOS stored in sealed containers with a large air space or imperfectly sealed containers which allow air access over time.

It is likely that these impurities cause premature nucleation sites and consequently larger particles.

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